Complete Summary

GUIDELINE TITLE

Physical activity/exercise and diabetes.

BIBLIOGRAPHIC SOURCE(S)

Zinman B, Ruderman N, Campaigne BN, Devlin JT, Schneider SH. Physical activity/exercise and diabetes. Diabetes Care 2004 Jan;27(Suppl 1):S58-62. [9 references] PubMed

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

- Type 1 diabetes mellitus
- Type 2 diabetes mellitus

GUIDELINE CATEGORY

Evaluation
Management

CLINICAL SPECIALTY

Endocrinology
Family Practice
Internal Medicine
Pediatrics
Physical Medicine and Rehabilitation
Sports Medicine

INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Nurses
Patients
Physical Therapists
Physician Assistants
Physicians

GUIDELINE OBJECTIVE(S)

To update and crystallize current thinking on the role of physical activity in patients with types 1 and 2 diabetes

TARGET POPULATION

- Individuals with type 1 diabetes mellitus
- Individuals with type 2 diabetes mellitus

INTERVENTIONS AND PRACTICES CONSIDERED

Evaluation

1. Medical history
2. Physical examination
3. Graded exercise testing, including:
    - Radionuclide stress test
    - Stress echocardiogram
    - Exercise stress test
    - Resting or stress thallium myocardial scintigraphy
4. Classification of physical activity intensity (see Table 2 in the original guideline document)
5. Touch sensation testing with monofilaments

Management

1. Patient education regarding self-management, warm-up, and cool-down periods
2. Aerobic exercise
3. Glucose monitoring
4. Medical nutrition therapy
5. General nutrition therapy
6. Insulin administration

MAJOR OUTCOMES CONSIDERED

- Prevention of diabetes-related morbidity and mortality
- Prevention of exercise-related diabetic morbidity

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Not stated

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Not stated

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not applicable

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

This paper was peer-reviewed, modified, and approved by the American Diabetes Association's Professional Practice Committee and Executive Committee and by the American College of Sports Medicine's Pronouncements Committee and Board of Trustees.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Evaluation of the Patient Before Exercise

Before increasing usual patterns of physical activity or an exercise program, the individual with diabetes mellitus should undergo a detailed medical evaluation with appropriate diagnostic studies. This examination should carefully screen for the presence of macro- and microvascular complications that may be worsened by the exercise program. Identification of areas of concern will allow the design of an individualized exercise prescription that can minimize risk to the patient.

A careful medical history and physical examination should focus on the symptoms and signs of disease affecting the heart and blood vessels, eyes, kidneys, feet, and nervous system.

Cardiovascular System

A graded exercise test may be helpful if a patient, about to embark on a moderate to high-intensity physical activity program, is at high risk for underlying cardiovascular disease, based on one of the following criteria:

- Age >35 years
- Age >25 years and
    - Type 2 diabetes of >10 years' duration
    - Type 1 diabetes of >15 years' duration
- Presence of any additional risk factor for coronary artery disease
- Presence of microvascular disease (proliferative retinopathy or nephropathy, including microalbuminuria)
- Peripheral vascular disease
- Autonomic neuropathy

In some patients who exhibit nonspecific electrocardiogram (ECG) changes in response to exercise, or who have nonspecific ST and T wave changes on the resting ECG, alternative tests such as radionuclide stress testing may be performed. In patients planning to participate in low-intensity forms of physical activity (<60% of maximal heart rate) such as walking, the physician should use clinical judgment in deciding whether to recommend an exercise stress test. Patients with known coronary artery disease should undergo a supervised

evaluation of the ischemic response to exercise, ischemic threshold, and the propensity to arrhythmia during exercise. In many cases, left ventricular systolic function at rest and during its response to exercise should be assessed.

Peripheral Arterial Disease

Evaluation of peripheral arterial disease is based on signs and symptoms, including intermittent claudication, cold feet, decreased or absent pulses, atrophy of subcutaneous tissues, and hair loss. The basic treatment for intermittent claudication is nonsmoking and a supervised physical activity program. The presence of a dorsalis pedis and posterior tibial pulse does not rule out ischemic changes in the forefoot. If there is any question about blood flow to the forefoot and toes on physical examination, toe pressures as well as Doppler pressures at the ankle should be carried out.

Retinopathy

The eye examination schedule should follow the American Diabetes Association's Clinical Practice Recommendations. For patients who have proliferative diabetic retinopathy that is active, strenuous activity may precipitate vitreous hemorrhage or traction retinal detachment. These individuals should avoid anaerobic exercise and physical activity that involves straining, jarring, or Valsalva-like maneuvers. Table 2 in the original guideline document provides information on assessing the risk of physical activity for these patients.

Nephropathy

Specific physical activity recommendations have not been developed for patients with incipient (microalbuminuria >20 mg/min albumin excretion) or overt nephropathy (>200 mg/min). Patients with overt nephropathy often have a reduced capacity for physical activity, which leads to self-limitation in activity level. Although there is no clear reason to limit low- to moderate-intensity forms of activity, high-intensity or strenuous physical activity should probably be discouraged in these individuals unless blood pressure is carefully monitored during exercise.

Neuropathy: Peripheral

Peripheral neuropathy (PN) may result in loss of protective sensation in the feet. Significant PN is an indication to limit weight-bearing exercise. Repetitive exercise on insensitive feet can ultimately lead to ulceration and fractures. Evaluation of PN can be made by checking the deep tendon reflexes, vibratory sense, and position sense. Touch sensation can best be evaluated by using monofilaments. The inability to detect sensation using the 5.07 (10 g) monofilament is indicative of the loss of protective sensation. Refer to the "Contraindications Field" for contraindicated physical activity for patients with loss of protective sensation in the feet.

Neuropathy: Autonomic

The presence of autonomic neuropathy may limit an individual's physical activity capacity and increase the risk of an adverse cardiovascular event during physical activity. Cardiac autonomic neuropathy (CAN) may be indicated by resting tachycardia (>100 beats per minute), orthostasis (a fall in systolic blood pressure >20 mmHg upon standing), or other disturbances in autonomic nervous system function involving the skin, pupils, gastrointestinal, or genitourinary systems. Sudden death and silent myocardial ischemia have been attributed to CAN in diabetes. Resting or stress thallium myocardial scintigraphy is an appropriate noninvasive test for the presence and extent of macrovascular coronary artery disease in these individuals. Hypotension and hypertension after vigorous physical activity are more likely to develop in patients with autonomic neuropathy, particularly when starting a physical activity program. Because these individuals may have difficulty with thermoregulation, they should be advised to avoid physical activity in hot or cold environments and to be vigilant about adequate hydration.

Preparing for Exercise

A standard recommendation for diabetic patients, as for nondiabetic individuals, is that physical activity includes a proper warm-up and cool-down period.

There are several considerations that are particularly important and specific to the individual with diabetes.

- Aerobic physical activity should be recommended, but taking precautionary measures for physical activity involving the feet is essential for many patients with diabetes. The use of silica gel or air midsoles as well as polyester or blend (cotton-polyester) socks to prevent blisters and keep the feet dry is important for minimizing trauma to the feet. Proper footwear is essential and must be emphasized for people with PN. Individuals must be taught to monitor closely for blisters and other potential damage to their feet, both before and after physical activity. A diabetes identification bracelet or shoe tag should be clearly visible when exercising.
- Proper hydration is also essential, as dehydration can affect blood glucose levels and heart function adversely. Physical activity in heat requires special attention to maintaining hydration. Adequate hydration prior to physical activity is recommended. During physical activity, fluid should be taken early and frequently in an amount sufficient to compensate in losses in sweat reflected in body weight loss, or the maximal amount of fluid tolerated. Precautions should be taken when exercising in extremely hot or cold environments.
- High-resistance exercise using weights may be acceptable for young individuals with diabetes. Moderate weight training programs that utilize light weights and high repetitions can be used for maintaining or enhancing upper body strength to nearly all patients with diabetes.

Summary of Exercise Recommendations for Patients with Type 2 Diabetes (From: Schneider, SH, Ruderman NB. Technical Review: Exercise and NIDDM. Diabetes Care 1990;13:785-9)

1. Screening:

- Search for vascular and neurological complications including silent ischemic heart disease
- Stress electrocardiogram in patients >35 years of age

2. Exercise program:
   - Type: Aerobic
   - Intensity: 50-70% of maximum aerobic capacity
   - Duration: 20-60 minutes
   - Frequency: 3-5 times per week
   - Avoid complications:
     - Warm up and cool down
     - Careful selection of exercise type and intensity
     - Patient education
     - Monitoring of blood glucose by patient and overall program by medical personnel
3. Compliance:
   - Make exercise enjoyable
   - Convenient location
   - Positive feedback from involved medical personnel and family

General Recommendations for Exercise in the Individual with Type 1 Diabetes
(From: Wasserman, DH, Zinman B. Technical Review: Exercise in individuals with IDDM. Diabetes Care 1994;17:924-37).

1. Physician screening before the initiation of an exercise program
   - An exercise stress test may be indicated to test for abnormalities in myocardial function and to determine a suitable work intensity for the exercise program
   - Exercise modalities must be identified that might be contraindicated for any specific complications that may be present
   - Individuals should be counseled on strategies for adjustment of diet and insulin administration
2. Metabolic control before physical activity
   - Avoid physical activity if fasting glucose levels are >250 mg/dl and ketosis is present, and use caution if glucose levels are >300 mg/dl and no ketosis is present
   - Ingest added carbohydrate if glucose levels are <100 mg/dl
3. Blood glucose monitoring before and after physical activity
   - Identify when changes in insulin or food intake are necessary
   - Learn the glycemic response to different physical activity conditions
4. Food intake
   - Consume added carbohydrate as needed to avoid hypoglycemia
   - Carbohydrate-based foods should be readily available during and after physical activity
5. Insulin administration
   - Avoid exercise during peak insulin action
   - Reduce the insulin dose when exercise is anticipated
   - Administer insulin away from the working limbs

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is not specifically stated for each recommendation.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Type 2 Diabetes

- Glycemic control: Several long-term studies have demonstrated a consistent beneficial effect of regular physical activity training on carbohydrate metabolism and insulin sensitivity, which can be maintained for at least 5 years.
- Prevention of cardiovascular disease: Improvement in many of the risk factors associated with cardiovascular disease has been linked to a decrease in plasma insulin levels, and it is likely that many of the beneficial effects of physical activity on cardiovascular risk are related to improvements in insulin sensitivity.
- Hyperlipidemia: Regular physical activity has consistently been shown to be effective in reducing levels of triglyceride-rich very low-density lipoprotein; Effects on levels of low-density lipoprotein cholesterol have not been consistently documented; most studies failed to demonstrate a significant improvement in levels of high-density lipoprotein.
- Hypertension: Effects of physical activity on reducing blood pressure levels have been demonstrated most consistently in hyperinsulinemic subjects.
- Obesity: Data have accumulated suggesting that physical activity may enhance weight loss and, in particular, weight maintenance when used along with an appropriate calorie-controlled meal plan.
- Prevention of type 2 diabetes: There are now three published trials documenting that with lifestyle modification (weight loss, regular moderate physical activity), diabetes can be delayed or prevented.

Type 1 Diabetes

Since diabetes is associated with an increased risk of macrovascular disease, the benefit of physical activity in improving known risk factors for atherosclerosis is to be highly valued. This is particularly true in that physical activity can improve the lipoprotein profile, reduce blood pressure, and improve cardiovascular fitness. However, it must also be appreciated that several studies have failed to show an independent effect of physical activity training on improving glycemic control as measured by glycated hemoglobin in patients with type 1 diabetes. Indeed, these studies have been valuable in changing the focus for physical activity in diabetes from glucose control to that of an important life behavior with multiple benefits.

Exercise in the Elderly

The decrease in insulin sensitivity with aging is partly due to a lack of physical activity. A number of recent studies of exercise training have included significant numbers of older patients who have done well with good training and metabolic responses, levels of adherence as least as good as the general population, and an acceptable incidence of complications. It is likely that maintaining better levels of fitness in this population will lead to less chronic vascular disease and an improved quality of life.

POTENTIAL HARMS

- Strenuous activity may precipitate vitreous hemorrhage or traction retinal detachment in patients who have proliferative diabetic retinopathy that is active.
- High-intensity or strenuous physical activity should probably be discouraged in patients with overt nephropathy unless blood pressure is carefully monitored during exercise.
- Significant peripheral neuropathy is an indication to limit weight-bearing exercise.
- Hypotension and hypertension after vigorous physical activity are more likely to develop in patients with autonomic neuropathy, particularly when starting a physical activity program.

CONTRAINDICATIONS

CONTRAINDICATIONS

The following exercises are contraindicated for diabetic patients with loss of protective sensation:

- Treadmill
- Prolonged walking
- Jogging
- Step exercises

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

Evidence is only one component of clinical decision-making. Clinicians care for patients, not populations; guidelines must always be interpreted with the needs of the individual patient in mind. Individual circumstances, such as comorbid and coexisting diseases, age, education, disability, and above all, patient's values and preferences, must also be considered and may lead to different treatment targets and strategies. Also, conventional evidence hierarchies, such as the one adapted by American Diabetes Association, may miss some nuances that are important in diabetes care.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness
Staying Healthy

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

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ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1990 Feb (revised 1999; republished 2004 Jan)

GUIDELINE DEVELOPER(S)

American College of Sports Medicine - Medical Specialty Society
American Diabetes Association - Professional Association

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GUIDELINE COMMITTEE

Professional Practice Committee

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Authors of Position Statement, Initial Draft: Bernard Zinman, MD (co-chair); Neil Ruderman, MD, DPhil (co-chair); Barbara N. Campaigne, PhD; John T. Devlin, MD; and Stephen H. Schneider, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

The guideline was originally approved in February 1990; the most recent review/revision was completed in 2002.

American Diabetes Association (ADA) position statements are reissued annually.

GUIDELINE AVAILABILITY

Electronic copies: Available from the American Diabetes Association (ADA) Web site.

Print copies: Available from American Diabetes Association, 1701 North Beauregard Street, Alexandria, VA 22311.

AVAILABILITY OF COMPANION DOCUMENTS

The recommendations in this paper are based on the evidence reviewed in the following publications:

- Schneider, SH, Ruderman NB. Exercise and NIDDM (Technical Review). Diabetes Care 1990;13:785-9.
- Wasserman, DH, Zinman B. Exercise in individuals with IDDM (Technical Review). Diabetes Care 1994;17:924-37.

Print copies: Available from the American Diabetes Association (ADA), 1701 North Beauregard Street, Alexandria, VA 22311.

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on November 1, 1998. The information was verified by the guideline developer on December 15, 1998. It was updated by ECRI on April 1, 2000, April 2, 2001, January 29, 2002, July 29, 2003, and March 23, 2004.

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